A THICKENER FOR CONCENTRATION OF FIBER SUSPENSIONS

FIELD OF THE INVENTION

[0001] The present invention relates to a thickener for concentrating a fiber suspension containing relatively coarse undesired particles.

BACKGROUND OF THE INVENTION

[0002] In the pulp production industry fiber pulp suspensions are treated in several subsequent process steps, each process step utilizing separate process equipment. As many pumps are required for the transportation of the fiber pulp suspension as there are process steps in which the suspension is being treated in the respective process steps. A plurality of such process steps typically comprise a series of thickening and washing steps, in which the fiber pulp suspension is concentrated and washed.

[0003] To prevent apparatuses in the thickening and washing steps from being damaged by coarse particulate contaminates the fiber pulp suspension is first screened in one or more screening steps. The screening of the fiber pulp suspension is normally carried out at relatively low fiber concentrations of the suspension; e.g., lower than 5%. The thickening apparatus in a first thickening step directly after the last screening step thus receives a fiber pulp suspension having a relatively low fiber concentration.

[0004] Since the capacity of traditional thickening apparatuses often relates to the fiber concentration of incoming fiber pulp suspensions it is common practice to design the first thickening step with a relatively large capacity to be capable of handling the relatively large flow of the fiber suspension fed to the first thickening step. This results in the disadvantage that the thickening apparatus of the first thickening step will be large and space demanding. A way of eliminating this disadvantage has been to install a

separate pre-dewatering apparatus between the last screening step and the first thickening step. Of course, such a pre-dewatering apparatus requires an additional pump.

[0005] One of the objects of the present invention is to provide a thickener that rationalizes the above described process steps and eliminates the need for designing the first thickening step larger than the subsequent thickening steps, or, alternatively, eliminates the need for installing a separate pre-dewatering apparatus.

SUMMARY OF THE INVENTION

[0006] In accordance with the present invention, this and other objects have now been realized by the invention of a thickener for concentration of a fiber suspension containing relatively coarse undesired particles, comprising a housing, a rotor arranged in the housing, a screen member attached to the rotor and including screen passages dimensioned for separating the fiber suspension into a first fraction of the fiber suspension passing through the screen member and substantially containing fibers, and a second fraction not passing through the screen member and containing the coarse undesired particles, a stationary thickening member surrounding at least a portion of the rotor and provided with a multiplicity of through holes, and supply means arranged in the housing for supplying the first fraction of the fiber suspension to the stationary thickening member, whereby the stationary thickening member can separate the first fraction into a third fraction passing through the multiplicity of through holes in the stationary thickening member, and a fourth fraction not passing through the multiplicity of through holes in the stationary thickening member, the multiplicity of through holes being dimensioned such that substantially only liquid is permitted to pass through the stationary thickening member, and the fourth fraction of the fiber suspension comprises

thickened fiber pulp free of the undesired coarse particles. Preferably, the screen member is tubular and is coaxially attached to the rotor. In another embodiment of the thickener of the present invention, the stationary thickening member is tubular and coaxially surrounds the rotor.

[0007] In accordance with another embodiment of the thickener of the present invention, the fiber suspension to be thickened has a fiber concentration in the range of 0.5 to 5%.

[0008] The objects of the present invention are obtained by means of a thickener comprising a housing, a rotor arranged in the housing, a screen member attached to the rotor and having screen passages dimensioned for separating the fiber suspension into a first fraction of the fiber suspension passing through the screen member and substantially containing fibers, and a second fraction not passing through the screen member and containing the coarse undesired particles, a stationary thickening member surrounding the rotor and provided with a multiplicity of through holes, and means arranged in the housing for supplying the first fraction of the fiber suspension to the thickening member, so that the thickening member separates the first fraction into a third fraction passing through the holes of the thickening member, and a fourth fraction not passing through the holes of the thickening member, wherein the holes of the thickening member are dimensioned such that liquid but not fibers is allowed to pass through the thickening member, whereby the fourth fraction of the fiber suspension produced during operation constitutes thickened fiber pulp free from undesired coarse particles.

[0009] As a result, an integrated apparatus is obtained which is capable of separating undesired particulate contaminates that could damage subsequent process equipment, for example thickening apparatuses, and of providing

thickening of the fiber pulp suspension that eliminates the need for designing the first thickening step with a larger capacity than the subsequent thickening steps, or alternatively, eliminates the need for installing a separate pre-dewatering apparatus with a necessary pump. In addition to this, the energy consumption is reduced, since the separation of coarse particles and thickening of the fiber pulp suspension can be integrated in one and the same apparatus.

[0010] In accordance with a preferred embodiment of the present invention, the screen member is tubular and coaxially attached to the rotor. The stationary thickening member is also tubular and surrounds the rotor coaxially with the latter.

[0011] The fiber suspension to be thickened by the thickener according to the present invention preferably has a fiber concentration in the range of 0.5 to 5%.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The present invention may be more fully appreciated by reference to the following detailed description which, in turn, refers to the accompanying drawings in which:

[0013] FIG. 1 is a side, elevational, cross-sectional view of a thickener in accordance with the present invention.

DETAILED DESCRIPTION

[0014] With reference to the drawing, a thickener according to the present invention is shown which is intended for thickening of fiber suspensions, preferably fiber pulp suspensions, containing relatively coarse undesired particles. The thickener comprises a pressurized housing 1 and a rotor member 2 arranged in the pressurized housing 1 and rotatable about a rotor axis 3. A first tubular screen member 4 is coaxially attached to the rotor member 2, whereby the screen member 4 rotates as the rotor member 2 rotates. The rotatable screen member 4 divides the interior of the housing 1 into a

first inlet chamber 5 outside the rotatable screen member 4 and a first outlet chamber 6 within the tubular screen member 4. To obtain strong centrifugal forces as an aid to the separating of heavier particles out of the fiber suspension to be separated, the first inlet chamber 5 should not be too large. The first inlet chamber is inwardly limited by a stator 7 with one or more stationary pulse members 8 arranged in the inside of the rotatable screen member 4. The rotatable screen member 4 and stator 7 are coaxially arranged. The pulse members 8 are adapted to create suction pulses when the rotatable screen member 4 rotates. These suction pulses help to conduct the first fraction of the fiber suspension from the first inlet chamber 5 and into the first outlet chamber 6.

[0015] The rotatable screen member 4, with the first inlet chamber 5, the first outlet chamber 6 and stator 7, constitute a screening step.

[0016] In the upper part of the housing 1 there is a tubular thickening member 9, which is stationary. The stationary thickening member 9 divides the interior of the housing 1 so that a second inlet chamber 10 is formed inside the stationary thickening member 9 and a second outlet chamber 12 is formed outside the stationary thickening member 9.

[0017] The stationary thickening member 9, the second inlet chamber 10 and the second outlet chamber 12 constitute a thickening step.

[0018] The rotatable screen member 4 may be any type of screen member with screen openings of suitable sizes to accept fibers and reject coarse particles. For example, the screen member 4 may have slots with openings between 0.1 mm and 0.5 mm or holes having diameters between 0.1 mm and 12 mm. The stationary thickening member 9 has through holes that permit dewatering of the first fraction of the fiber suspension without passing through fibers of desired size. For example,

the stationary thickening member 9 may have holes with a diameter between 0.1 mm and 1.2 mm, preferably between 0.2 and 1.0 mm, and most preferably between 0.3 and 0.8 mm.

[0019] The largest diameter of the inlet chamber 5 is smaller than the smallest diameter of the second inlet chamber 10. This enables the first inlet chamber 5 to be partially arranged within the second inlet chamber 10. In the embodiment shown in the drawing the inner delimiting surface of the second inlet chamber 10 has a cylindrical shape and the inner delimiting surface of the first inlet chamber 5 likewise has a cylindrical shape. Of course, they may also take other shapes, such as conical shapes.

[0020] Thus, the screening step is at least partially arranged inside the thickening step and, consequently, the rotatable screen member 4 is at least partially arranged inside the stationary thickening member 9 (telescopically). The rotatable screen member 4 has a substantially smaller diameter than the stationary thickening member 9. Even a diameter which is 25% smaller than the stationary thickening member 9 provides significantly reduced energy consumption. However, the diameter of the rotatable screen member 4 is preferably at least 35% smaller, and most preferably up to 50% smaller than the diameter of the stationary thickening member 9. To make it possible that the screening step will have as much capacity as the thickening step the first screening step can be designed to be relatively high without changing the total height of the thickener.

[0021] The fiber pulp suspension to be thickened is supplied through an inlet member 13 to the first inlet chamber 5, so that the fiber suspension separates into said first fraction of the fiber suspension that passes through the rotatable screening member 4 and substantially contains fibers, and a second fraction of the fiber suspension that

does not pass through the rotatable screening member and contains coarse undesired particles. The second fraction is discharged from the inlet chamber through a reject outlet 14. The first fraction of the fiber suspension flows upwardly through the first outlet chamber 6 and out through an outlet in the top portion thereof. Then, the first fraction flows further upwardly within the rotor member 2 and out above the latter. From that point, it flows downwardly into the second inlet chamber 10.

[0022] The first fraction that flows into the second inlet chamber 10 is thickened by the stationary thickening member 9 into a third fraction that passes through the holes of the thickening member 9 and substantially contains only water and a portion of small fiber fragments, and a fourth fraction that does not pass through the thickening member 9 and contains thickened fiber pulp. The formed thickened fiber pulp is discharged from the second inlet chamber 10 through an outlet member 15, whereas separated water is discharged from the second outlet chamber 12 through an outlet member 16.

[0023] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.